

Preface

In February 1997, the U.S. Environmental Protection Agency (EPA) hosted a public meeting in Washington, DC, to discuss its concerns about the ability of aftermarket vehicle conversions to satisfy federal emissions standards. Those concerns had been heightened by the recent publication of data indicating that vehicles may exhibit increases in one or more regulated pollutants after their fuel systems are converted from a conventional fuel to an alternative fuel.

As a direct result of the meeting, the U.S. Department of Energy (DOE) offered to fund the development of a simple and straightforward reference guide designed to explain the processes of emissions certification for aftermarket conversions. DOE's offer was extended to satisfy stakeholders' requests for more succinct explanations of the certification requirements of various regulatory agencies. DOE's National Renewable Energy Laboratory (NREL) was assigned the task of collecting the information and publishing the guide.

Since the meeting in February, the EPA has made two important announcements that relate to the certification of aftermarket vehicle conversions. The first occurred on September 4, 1997, when the EPA issued an addendum to Mobile Source Enforcement Memorandum 1A. This document provides clarifications and revisions of the agency's tampering enforcement policy for alternative fuel aftermarket conversions. The second came on October 31, 1997 (just before this guide was published) in which EPA proposed changes to the certification procedures designed to ease the burden of certification for vehicle manufacturers who qualify for the Clean-Fuel Vehicle Program. Details from both announcements are covered in this guide.

The guide contains extensive information provided by the EPA, the California Air Resources Board (CARB), and the Colorado Department of Public Health and Environment, as well as numerous fleet managers, cooperative industry organizations, and equipment manufacturers, installers, and distributors. NREL and DOE gratefully acknowledge the contributions of each project participant.



Photo Courtesy of Natural Fuels Corporation/PIX 05137

Technician performing a quality assurance inspection of an aftermarket conversion installation

Introduction

Emissions certification is still relatively new to the aftermarket vehicle conversion industry. Many in the industry think that as soon as a vehicle is converted to operate on compressed natural gas (CNG) or liquefied petroleum gas (LPG), it automatically runs as clean as or cleaner than it did on the conventional fuel. However, recent studies have shown that aftermarket conversions may not always reduce emissions. To achieve emissions benefits, the conversion equipment must be designed and calibrated specifically for the engine and emissions control system on which it has been installed, and the installation and setup must be performed so as to not adversely affect the vehicle's original emissions performance. The reason for certification, then, is to ensure that these criteria are met, that the vehicle continues to perform properly, and that it continues to satisfy all appropriate emissions standards throughout its useful life.

How to Use This Guide

We have prepared this guide to help equipment manufacturers, distributors, and installers understand the emissions certification process for aftermarket conversions. First and foremost, the guide gives an overview of the certification requirements established by the U.S. Environmental Protection Agency (EPA) and the state of California. It includes information about the regulations that apply to certification, identifies key steps in the certification process, provides contacts and reference sources for additional

information, and includes summaries of emissions standards.

The material presented here relates to dedicated and dual-fuel conversion types designed to operate on CNG, liquefied natural gas (LNG), or LPG fuels. It applies to light-duty vehicles and trucks, medium- and heavy-duty vehicles (California only), and heavy-duty engines. The test procedures and regulations for certifying LNG are identical to those for CNG. Therefore, to minimize repetition of the terms CNG and LNG, we use CNG only, although either term or both terms could be used.

Some Words about Terminology

Appendix A is an extensive glossary of terms. However, a few terms require early clarification.

1. **Aftermarket conversion**—a vehicle or engine originally designed and certified to operate on gasoline or diesel that has been modified to run on an alternative fuel. **Retrofit kit or system, aftermarket conversion, and conversion** all have the same meaning, but for the sake of consistency, we use “aftermarket conversion” throughout this guide.
2. **Dual-fuel**—we use the term “dual-fuel” to refer to vehicles or engines that have two separate fuel systems and are designed to run on either an alternative fuel or conventional gasoline, but using only one fuel at a time. This is consistent with the usage of the term in EPA and California regulations.
3. **Manufacturer**—in the context of this guide, “manufacturer” refers to any company that produces, assembles, or packages aftermarket vehicle conversion kits.
4. **Emissions standards, procedures, and regulations**—the regulations governing aftermarket conversions also include references to emissions standards and acceptable testing and implementation procedures. Procedures are the methods that a manufacturer uses to test vehicles, systems, or components. A standard is a regulated emissions level. Examples of emissions standards are tier 1, transitional low-emission vehicle (TLEV), and low-emission vehicle (LEV). The sidebar on page 17 provides more information about these standards.
5. **Vehicle and engine**—We use the terms “vehicle” and “engine” frequently in the guide. In some parts of the certification process, different regulations or procedures apply depending on whether you are certifying a vehicle or an engine. In others, the regulations and procedures are identical for engines and vehicles. When there are no differences, we use the term “vehicle” frequently in this guide to imply all vehicles and engines. This helps to avoid repeating “vehicle and/or engine” throughout. Unless otherwise specified, the term “engine” is used to refer to heavy-duty engines. Other specific terms used in the guide and the regulations include light-duty vehicle, light-duty truck, medium-duty vehicle, and heavy-duty vehicle. These terms are defined in the glossary.

Because EPA and California certification processes differ, we have devoted a separate section of the guide to each. In each section, we have attempted to lead you through all the major steps in the emissions certification process.

First, we provide contact information for each agency. Then, we present an overview of the governing regulations, with specific references to the necessary documentation. We explain the certification process (with a flow chart for visual reference), provide examples, and define important terms. Emissions standards and test procedures are outlined and accompanied by references to the appropriate sections of the regulations. Finally, we describe other responsibilities and requirements (such as information labels, warranty requirements, and record keeping) needed to obtain an emissions certification.

The two sections in the back of the guide provide answers to “Frequently Asked Questions” and detailed reference material in the form of appendices. The appendices include a glossary of terms, sample schematic diagrams, informative World Wide Web sites, emissions standards, fuel specifications, additional flow charts, and an index of related documents.

The guide is not meant to replace the use of EPA and California regulations; it is designed to give an overview and to serve as a reference. The official regulations are the cornerstone for emissions certification—they explain the detailed test procedures and the emissions standards. Any discrepancy between this guide and the regulations is unintentional. Because both EPA and California regulations are constantly being updated, consult with the EPA and the California Air Resources Board (CARB) to ensure that you have current information. If you’re interested in certifying vehicles, always refer to the actual regulations governing the vehicles or engines you wish to convert.

What Is an Aftermarket Conversion?

An aftermarket conversion is a vehicle that was originally designed, produced, and certified by an original equipment manufacturer (OEM) to operate on a particular fuel and has been altered to allow it to operate on a different fuel. Typically, an aftermarket conversion involves modifying a gasoline- or diesel-fueled vehicle to run on CNG or LPG. After conversion, the vehicle may be “dedicated” to an alternative fuel, meaning that it can operate solely on the new fuel, or it can be “dual-fuel,” meaning that it can run either on the conventional fuel or the alternative fuel, but not on both simultaneously. In the context of this guide, dual-fuel vehicles produced under the qualified vehicle modifier programs of various OEMs are not considered to be aftermarket conversions.

Aftermarket conversion of vehicles involves removing, altering, or replacing various fuel system components. The conversion equipment is frequently called a “conversion kit.” Many companies produce conversion kits, and each kit has its own unique characteristics. Schematics of two such kits, which are commercially available today, are contained in Appendix B.

A Historical Perspective

Emissions control regulations date back to the early and mid-1960s. California required its first emissions control systems on 1966 vehicles. In 1967, CARB was established to ensure the protection of air quality, including motor vehicle emissions.

In 1970, the federal Clean Air Act (CAA) was adopted and the EPA was created. The CAA gave the EPA broad responsibilities for regulating motor vehicle pollution. Emissions standards for crankcase, exhaust, and evaporative emissions from light-duty vehicles, as well as standards for exhaust emissions from heavy-duty

gasoline- and diesel-fueled engines, became effective during that same year.

In 1974, the EPA issued an important policy statement known as Memorandum 1A (“Interim Tampering Enforcement Policy,” see page 7), which outlined steps that aftermarket conversion companies could take to ensure that installing their kits and equipment did not violate the CAA’s anti-tampering provisions. One such method was to obtain a representation from a state environmental control agency that the converted vehicle’s emissions performance had not been compromised. For instance, through its Regulation No. 14 (“The Control of Emissions from Alternative Fueled Motor Vehicles”), the Colorado Department of Health and Environment provided a process for obtaining a “Letter of Certification” for vehicles converted in Colorado.

California has had the longest-running certification program for aftermarket conversions, establishing its first regulations in 1975. Since then, California has updated its certification procedures for aftermarket conversions a number of times.

In 1994, the EPA established the first national emissions standards and regulations for vehicles and engines powered by CNG and LPG (see 59 *Federal Register* [FR] 48472). These standards and regulations apply to aftermarket conversions and vehicles produced by OEMs. The certification process outlined in the EPA’s rule-making was optional prior to the 1997 vehicle model year, but it is required for 1997 and successive model years. Prior to 1994, no federal emissions standards or test procedures existed for CNG and LPG vehicles.

On September 4, 1997, the EPA revised and updated the tampering enforcement policy with an addendum to Mobile Source Enforcement Memorandum 1A (“Tampering Enforcement Policy for Alternative Fuel Aftermarket Conversions”). As outlined in the addendum, the EPA no longer accepts Colorado

Regulation No. 14 or the California certification procedure for 1993 and earlier model year vehicles as an adequate demonstration that a vehicle or engine modified with an aftermarket conversion system complies with the applicable emission standards for its useful life. The addendum outlines three alternatives for providing a reasonable basis that an aftermarket conversion does not adversely affect emissions performance. The EPA section of this guide presents additional information on the addendum.

Authority for Emissions Certification

Section 209 of the CAA provides that “no state or political subdivision thereof shall adopt or attempt to enforce any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines subject to this part.” However, this requirement is waived for states that adopted emissions control standards prior to March 30, 1966. Based on this waiver, the state of California may adopt and enforce its own emissions standards.

In all cases, manufacturers of new motor vehicles and engines must receive certification from the EPA before the vehicles can be introduced into commerce. For California-only vehicles, the manufacturer first obtains certification from CARB, then submits this to the EPA for certification. The EPA will then issue a California-only certificate. For all other new vehicles, manufacturers must first obtain a certificate from the EPA. This also applies to aftermarket conversions, except for vehicles converted according to the steps outlined in the addendum to Mobile Source Enforcement Memorandum 1A.

Currently, manufacturers may obtain emissions certification for aftermarket conversions from the EPA and the state of California. For more information on this subject, see the sections of this guide on EPA and California certification, along with the section entitled Frequently Asked Questions.